Questions 10, 21 – 33 odd, 80, 90

10) a. Dissolve 40.00g of NaOH into enough distilled water to make a 1.000 L solution.

b. If 2.00M NaOH was available, I would dilute it with water until it had exactly double the volume.

c. The volume and mass would have to have at least 3 sig figs.

21. a. $\frac{5.623\text{g } NaHCO_3}{250.0\text{ mL}} \left| \frac{1\text{mol } NaHCO_3}{84.01\text{g } NaHCO_3} \right| \frac{1000\text{mL}}{1\text{L}} = \mathbf{0.2677\ mol/L\ NaHCO_3}$

b. $\frac{0.1846\text{ g } K_2Cr_2O_7}{500.0\text{ mL}} \left| \frac{1\text{ mol } K_2Cr_2O_7}{294.2\text{ g } K_2Cr_2O_7} \right| \frac{1000\text{mL}}{1\text{L}} = \mathbf{0.001255\ M\ K_2Cr_2O_7}$

c. $\frac{0.1025\text{g Cu}}{200.0\text{ mL}} \left| \frac{1\text{ mol Cu}}{63.55\text{ g Cu}} \right| \frac{1000\text{mL}}{1\text{L}} = \mathbf{0.008065\ M\ Cu^{2+}}$

23. a. $\frac{0.100\text{ mol } Ca(NO_3)_2}{0.1000\text{ L}} \left| \frac{1\text{ mol } Ca^{2+}\text{ ions}}{1\text{ mol } Ca(NO_3)_2} \right| = \mathbf{1.00\ mol/L\ Ca^{2+}}$

$\left| \frac{2\text{ mol } NO_3^-\text{ ions}}{1\text{ mol } Ca(NO_3)_2} \right| = \mathbf{2.00\ mol/L\ NO_3^-}$

b. $\frac{2.5\text{ mol } Na_2SO_4}{1.25\text{ L}} \left| \frac{2\text{ mol } Na^+\text{ ions}}{1\text{ mol } Na_2SO_4} \right| = \mathbf{4.0\ M\ Na^+}$

$\left| \frac{1\text{ mol } SO_4^{2-}\text{ ions}}{1\text{mol } Na_2SO_4} \right| = \mathbf{2.00\ M\ SO_4^{2-}}$

c. $\frac{5.00\text{ g } NH_4Cl}{0.500\text{ L}} \left| \frac{1\text{ mol } NH_4Cl}{53.492\text{ g } NH_4Cl} \right| \frac{1\text{ mol each ion}}{1\text{ mol } NH_4Cl} = \mathbf{0.187\ M\ NH_4^+}$

$= \mathbf{0.187\ M\ Cl^-}$

d. $\frac{1.00\text{ g } K_3PO_4}{0.250\text{ L}} \left| \frac{1\text{ mol } K_3PO_4}{212.24\text{ g } K_3PO_4} \right| \frac{3\text{ mol } K^+}{1\text{ mol } K_3PO_4} = \mathbf{0.0565\ M\ K^+}$

$\frac{1\text{ mol } PO_4^{3-}}{1\text{ mol } K_3PO_4} = \mathbf{0.0188\ M\ PO_4^{3-}}$

25) a. $\frac{0.1000\text{ L } AlCl_3 \mid 0.30\text{ mol } AlCl_3 \mid 3\text{ mol } Cl^-}{1\text{ L } AlCl_3 \mid 1\text{ mol } AlCl_3}$ = **0.090 M Cl^-**

$\frac{.0500\text{ L } MgCl_2 \mid 0.60\text{ mol } MgCl_2 \mid 2\text{ mol } Cl^-}{1\text{ L } MgCl_2 \mid 1\text{ mol } MgCl_2}$ = **0.060 M Cl^-**

$\frac{0.200\text{ L NaCl} \mid 0.40\text{ mol NaCl} \mid 1\text{ mol } Cl^-}{1\text{ L NaCl} \mid 1\text{ mol NaCl}}$ = **0.080 M Cl^-**

27) $\frac{0.250\text{ L NaOH} \mid 0.400\text{ mol NaOH} \mid 40.00\text{g NaOH}}{1\text{ L NaOH} \mid 1\text{ mol NaOH}}$ = **4.00 g NaOH**

29) a. $\frac{2.00\text{ L NaOH} \mid 0.250\text{ mol NaOH} \mid 40.00\text{g NaOH}}{1\text{ L NaOH} \mid 1\text{ mol NaOH}}$ = 20.0 g NaOH

Dilute 20.0g of NaOH with enough distilled water to make 2.00L

b. $0.250M \times 2.00L = 1.00M \times V_2$

$V_2 = 0.500L$

Dilute 500. mL of the NaOH solution with enough distilled water to make 2.00L

c. $\frac{2.00\text{ L } K_2CrO_4 \mid 0.100\text{ mol } K_2CrO_4 \mid 194.2\text{g } K_2CrO_4}{1\text{ L } K_2CrO_4 \mid 1\text{ mol } K_2CrO_4}$ = 38.8g K_2CrO_4

Dilute 38.8g of K_2CrO_4 with enough distilled water to make 2.00L

d. $0.100M \times 2.00L = 1.75M \times V_2$

$V_2 = 0.114L$

Dilute 114. mL of the K_2CrO_4 solution with enough distilled water to make 2.00L

31) $\frac{10.8\text{ g } (NH_4)_2SO_4 \mid 1\text{ mol } (NH_4)_2SO_4 \mid 2\text{ mol } NH_4^+}{0.100\text{ L solution} \mid 132.15\text{ g } (NH_4)_2SO_4 \mid 1\text{ mol } (NH_4)_2SO_4}$ = 1.63 M NH_4^+

= 0.817 M SO_4^{2-}

$10.0\text{ mL} \times 1.63\text{ M} = M_2 \times 60.0\text{ mL}$ M_2 = 0.272 M NH_4^+

= 0.136 M SO_4^{2-}

33) $\frac{0.0100\text{g } C_{20}H_{29}FO_3 \mid 1\text{ mol } C_{20}H_{29}FO_3}{0.500\text{ L solution} \mid 336.43\text{g } C_{20}H_{29}FO_3}$ = 5.95×10^{-5} M $C_{20}H_{29}FO_3$ (stock)

$0.100\text{ mL} \times 5.945 \times 10^{-5}\text{ M} = M_2 \times 100.0\text{ mL}$

$M_2 = 5.95 \times 10^{-8}$ M $C_{20}H_{29}FO_3$

80) 230.mL x 0.275M $CaCl_2$ = V_2 x 1.10M V_2 = 57.5 mL

230. mL - 57.5 mL = ***172.5 mL evaporated***

90) $2HCl + Mg \longrightarrow MgCl_2 + H_2$

$$\frac{3.00\text{ g Mg}}{} \left| \frac{1\text{ mol Mg}}{24.30\text{ g Mg}} \right| \frac{2\text{ mol HCl}}{1\text{ mol Mg}} \left| \frac{1\text{ L HCl}}{5.0\text{ mol HCl}} \right. = \textbf{0.049 L of 5.0M HCl}$$